



Oral cavity and pharynx cancer incidence rates in the United States, 1975–1998[☆]

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Abstract

To identify subgroups of oral cavity and pharynx (OCP) cancers that may be etiologically distinct, we evaluated age-adjusted incidence rates by histologic type, anatomical site, race, and sex using cases diagnosed during 1975–1998 in nine US Surveillance, Epidemiology, and End Results (SEER) program registries. Male/female rate ratios were about one for adenocarcinoma (AC), three or more for squamous cell carcinoma (SCC), and undetermined for Kaposi's sarcoma (KS). Among males, black/white rate ratios exceeded two for cancers of the palate, tonsil, oropharynx, and pyriform sinus, and were less than one only for lip and salivary gland cancers. Among females, rates by race were similar for all oral sites except lip, but rates for each of the pharynx subsites were higher among blacks. Findings suggest that OCP cancers may be separated into SCC of the lip, SCC of the oral cavity, SCC of the pharynx, AC, and KS. © 2002 Elsevier Science Ltd. All rights reserved.

Keywords: Oral; Pharynx; Cancer; SEER; Incidence

1. Introduction

Cancers of the oral cavity and pharynx (OCP) include tumors of the lip, tongue, gingival (gums), floor of the mouth, soft and hard palate, tonsils, salivary glands, oropharynx, nasopharynx, hypopharynx, and other less frequent sites [1]. In 2001, it was estimated that OCP cancers would account for 30,100 new cases and 7800 deaths in the United States [2]. The age-adjusted (world standard) incidence rate for total OCP cancers were 8.3 per 100,000 population in 1994–1998, but varies greatly (range = 4.8 to 17.7 per 100,000) according to race and sex groups [3]. These cancers represent 3% of all cancers in the United States [1].

More than 95% of all OCP cancers occur in persons 40 years of age or older, and the median age at time of diagnosis is in the sixth decade [1]. The major risk factors for OCP cancers are the use of tobacco products

and excessive alcohol consumption, estimated to account for 75% of all OCP in the United States [4]. Patterns and risks associated with tobacco and alcohol use have been shown to account for nearly all of the observed racial differences in rates for OCP cancers [5]. Other risk factors are exposure to certain viruses (humanpapilloma, Epstein–Barr) [6] and use of marijuana [7]. Nutritional factors, particularly the consumption of fresh fruits and vegetables, appear to be associated with decreased risk for these cancers [8,9]. Differences in rate patterns and risk factors for some subsites such as nasopharynx, lip, salivary glands, and other subsites also have been recognized [10,11].

Routine Surveillance, Epidemiology and End Results (SEER) program publications present recent rates by 10 subsites within the OCP, but the subsites are often grouped together in the SEER analyses presenting more detailed rates, such as by time, geographic area, stage at diagnosis, or years of survival. During 1975–1998, total oral cavity and pharynx cancer incidence rates have been higher among men than women, higher among blacks than whites, and fairly stable among females while declining among white males since the mid-1970s and rising among black males at least until the 1980s [3].

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Furthermore, SEER publications do not present data according to histologic cell type. It is known that carcinomas account for the overwhelming majority of all oral cancers (up to 96%), followed next by sarcomas [1]. Thus, the purpose of this paper is to present and evaluate age-adjusted incidence rates for cancers of oral cavity and pharynx subsites by histologic type and to explore temporal trends for these cancers by race and sex. This is the first time this information has been presented for oral cavity and pharynx cancers. This information is valuable because it identifies where disparities related to oral cancer exist.

2. Methods

Data for this analysis come from the US Surveillance, Epidemiology and End Results (SEER) program [3,12]. Nine registries (San Francisco–Oakland, Connecticut, Detroit, Hawaii, Iowa, New Mexico, Seattle, Utah, and Atlanta) for which data are available for cases diagnosed since 1975 were included in the analysis. Although these areas are not a random sample of the US population, they account for about 10% of the population. Population estimates were derived using data provided by the US Census Bureau. Age-adjusted (world standard) incidence rates for malignant cancers of the oral cavity and pharynx were calculated by sex, race, histologic type, specific oral cavity subsites, and expressed per 100,000 person-years. For the trend analysis, three time periods were used to obtain stable rates: 1975–1982, 1983–1990 and 1991–1998. In the early years, tumors were coded according to the Manual of Tumor Nomenclature and Coding (MOTNAC) [13]. Subsequently, the International Classification of Disease for Oncology, first and second edition (ICDO, ICDO-2) [14,15] were used; no changes in the categories occurred for oral cavity and pharynx cancers. All tumors of the oral cavity and pharynx were categorized according to the ICDO-2 codes for topography and morphology (Table 1) [15]. Data were reviewed and then collapsed into the categories presented in this analysis.

Figures were prepared using a log scale and uniform y:x axis ratio to allow comparisons not only within but also between figures [16]. The percent change (PC) in rates was calculated from 1975–1982 to 1991–1998.

3. Results

During the 1978–1998 period, a total of 65,130 in-situ and malignant cancers of the OCP were diagnosed, of which 98% were microscopically confirmed and approximately 5% were carcinoma in situ; to maximize the numbers available for analysis, all cases were included (Table 2). The majority of OCP cancers (83%) were

Table 1

ICDO-2 codes for topography and morphology used in the analysis

	ICDO-2 code
<i>Morphology</i>	
Squamous cell carcinoma	8050–8082
Adenocarcinoma	8140–8573
Kaposi's sarcoma	9140
Other (excluding lymphoma)	8000–8045, 8090–8130, 8680–9581
<i>Topography</i>	
Lip	000–009
Total tongue	019–029
Base of the tongue	019
Other specified tongue	020–024
Tongue, multiple sites	028–029
not further specified (MNS)	
Total gum	030–039
Upper gum	030
Lower gum	031
Gum MNS	039
Floor of the mouth	040–049
Total palate	050–059
Hard palate	050
Soft palate	051
Uvula	052
Palate MNS	058–059
Other mouth	060–069
Cheek and vestibule	060–061
Retromolar	062
Other mouth	068–069
Salivary glands MNS	079–089
Parotid gland	079
Other salivary glands MNS	080–089
Tonsil	090–099
Oropharynx	100–109
Nasopharynx	110–119
Pyiform sinus	129
Hypopharynx	130–139
Other oral cavity and pharynx MNS	140–149

squamous cell carcinomas (SCC). Of those, 87% were SCC, 9% keratinizing SCC, approximately 2% non-keratinizing SCC, 1% lymphoepithelial carcinoma, and less than 1% papillary carcinoma, papillary SCC, small cell nonkeratinizing, spindle cell type SCC, adenoid SCC, or microinvasive. Sixty-seven percent of SCC occurred in the oral cavity and 30% in the pharyngeal region and 3% had not site specified. The most common site for this histologic type in the oral cavity was the tongue and in the pharynx, the tonsils. Adenocarcinomas (AC) accounted for 9% of all OCP; they occurred mainly in the salivary glands, especially the parotid glands. Kaposi's sarcoma (KS) accounted for 1.2%, and they occurred in the palate, mostly in the hard palate. Approximately 4% and 10% of AC and KS, respectively, were found in the pharynx.

All OCP cancers occurred more frequently among males than females (Table 2). By type, the male/female rate ratios ranged from less than 1.02 for AC to 3–4 for SCC. By site, the male/female ratios for salivary gland

cancers were less than two in both races, and for lip cancers about two among blacks and almost nine among whites. For the remaining subsites, the male/female rate ratios generally were higher among blacks than whites, ranging to more than five for oropharynx and pyriform sinus cancers.

Incidence rates were higher among blacks than whites for most types and sites, especially among males, as shown in Table 2. By type, among males, the rate was 47% higher among blacks than whites for squamous cell carcinoma, 11% higher for AC, and 8% higher for KS. By type, rates were similar among white and black females for SCC and AC. By site, among males, black/white rate ratios exceeded two for cancers of the palate, tonsil and all pharyngeal subsites except the nasopharynx and hypopharynx. In contrast, male rates were notably higher among whites than blacks for cancer of the lip and very similar for gingival (gum) cancer. Among females, rates among whites and blacks were similar in the oral cavity except for cancers of the lip, gingival (gum) and salivary glands, in contrast to incidence rates for all subsites in the pharynx that were higher among blacks than whites.

Total, OCP incidence rates declined from 1975–1982 to 1991–1998 among all four race/sex groups (Table 3;

Table 3

Percent change (1975–1982 to 1992–1998) for oral cavity and pharynx cancer by race, sex, histologic type and anatomic site, 9-SEER^a

	White males	White females	Black males	Black females
Total	−14.0	−9.8	−6.4	−18.2
<i>Histologic type</i>				
SCC	−17.6	−13.3	−10.8	−20.0
Adenocarcinoma	11.4	12.9	9.6	−2.0
KS	3300	N/A	N/A	N/A
Other and NS	12.8	−19.5	47.4	−30.2
<i>Anatomic site</i>				
Lip	−45.3	3.3	−37.5	N/A
Tongue	10.7	5.2	−5.5	−14.7
Gum	−10.5	−7.4	−37.5	−51.5
Floor of the mouth	−30	−31.0	−30.4	−31.1
Other mouth	−16.9	−4.4	−8.9	−23.5
Salivary glands	14.0	5.9	39.7	−10
Palate	8	−15.2	0	−4.8
Tonsil	13.0	−21.7	4.8	−26.4
Oropharynx	−2.7	−26.7	16.5	50
Nasopharynx	−17.2	8.7	−3.3	−28.2
Pyriform sinus	−17.3	−25	−14.7	−30
Hypopharynx	−26.5	−23.5	15	−3.7
Other NS OCP	−6.4	−15.8	−5.1	13.6

^a N/A, not applicable. NS OCP, not specified oral cavity and pharynx.

declined among females. For cancers of the pharynx, rates generally declined among whites but they increased among black males for all sites except pyriform sinuses.

4. Discussion

Based on these data it appears that there are several distinct forms of OCP cancers, based on histologic type and anatomic site patterns by race, sex, and over time. Data presented here suggest that OCP cancers may be separated into five subgroups: SCC of the lip, SCC of the oral cavity, SCC of the pharynx (including nasopharynx), adenocarcinoma (including salivary glands), and Kaposi's sarcoma.

The most frequent sites for OCP cancers continue to be tongue and floor of the mouth (SCC of the oral cavity), followed closely by cancer of the tonsils (SCC pharynx). For the 1975–1998 period, SCC rates declined while AC increased among all groups except black females (Percentage change = −2.02) and KS rates increased particularly among males.

This analysis revealed variations according to histologic type, anatomic subsite, race, sex and temporal trends. Rates for SCC of the oral cavity were higher among black males than white males but were similar

among females. In general, palate, tonsil and pharynx cancer rates were higher among blacks than whites for both males and females, and could be grouped as SCC of the pharynx. Although males are affected two to three times as often as females in the USA, the incidence of tongue and other oral cavity cancers among women can be greater or equal to that of men in countries like India [17].

Black males had the highest incidence rates for OCP cancers and SCC. One exception was lip cancer, which was more frequent among whites. Lip cancer, which is associated with tobacco use and solar keratoses [10], continues to decline among males, although a slight increase was observed among white females (Fig. 2A). The decreases among males are in contrast to rising melanoma rates of another UV-radiation-related cancer [3]. Declines in cancers of the lip and other subsites of the oral cavity may be largely attributed to decreased use of cigarettes.

In contrast, tongue cancer rates rose among white males and females from 1975–1982 to 1991–1998. An earlier report using SEER data for 1973–1992 found that the increases were mainly in the age group of 35–39 years [18]. Further, an increase in tongue cancer among young adults has been reported in studies from the UK and across Europe [19].

The lack of higher gingival (gum) cancer rates among blacks compared to whites may be related to less use of snuff or chewing tobacco by blacks compared to whites [20]. The smaller male/female ratio for gingival (gum) cancer compared to other sites of the mouth might relate to snuff use among women. A previous study clearly demonstrated an increased risk of OCP among older white women who used snuff [21].

Alcohol use also has declined, though not as dramatically as smoking. The alcohol relationship with oral cancer has been well established, although the specific mechanism for its carcinogenic effect is not known [22]. Interactive effects between smoking and alcohol are important, particularly among current smokers. Studies that have looked at type and amount of alcohol consumed and its relation to OCP did not look at alcohol and specific OCP subsites. Men consume more alcoholic beverages than women, and more blacks abstain from alcohol than whites [22,23]. Such differences are consistent with the higher risk for OCP in men than women but do not explain the racial disparities observed.

Convincing evidence exists that diets high in fruits and vegetables decrease the risk for OCP [24]. Recent figures showed that only 34% of African Americans age 2 and older meet the Dietary Guidelines minimum average daily goal of at least five servings of vegetables and fruits in a day, in contrast to 41% of whites [25]. A diet that includes fresh fruit and vegetables rich in beta-carotene, vitamin C, and vitamin E has been associated with a reduced risk of oral cavity and pharynx cancers

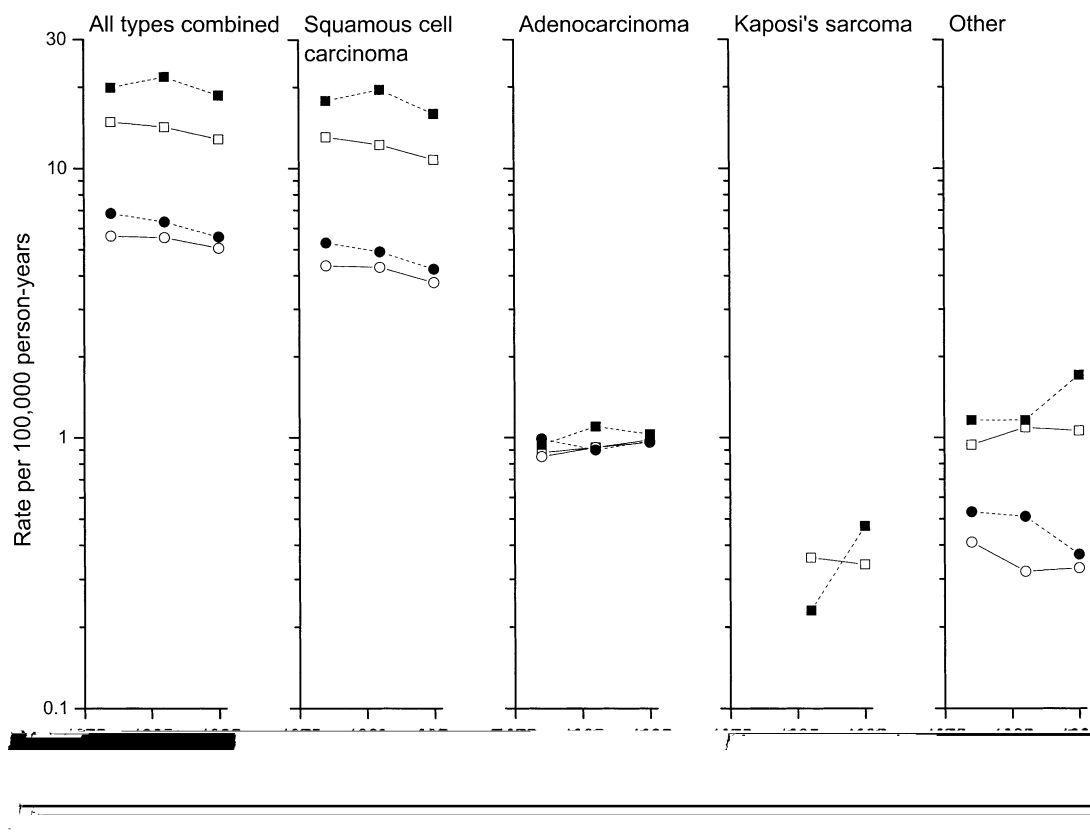


Fig. 1. 1975–1982 to 1991–1998 age-adjusted (world) incidence trends by type. Oral cavity and pharynx cancers in the nine SEER areas.

[26]. A previous study comparing diets of whites and blacks concluded that the diets were similar in fruit, vegetable and fat consumption [27]. It was suggested that blacks were more frequent consumers of preserved and processed meats that tend to be high in N-nitroso compounds.

In addition, nutritional deficiencies of iron, riboflavin, and other vitamins have been implicated in Plummer-Vinson Syndrome, a condition seen particularly among Swedish women that predisposed them to some forms of pharyngeal cancer. Incidence of oral cancers in Sweden declined with the advent of iron and vitamin supplementation [26]. These deficiencies could contribute to higher pharyngeal cancer incidence rates observed among black females. Presently, detailed information on diet by sex and race are not available.

Environmental exposures such as radiation and nitrosamines have been linked to OCP cancers [10,28–30]. Adenocarcinomas occur predominantly in the salivary glands, and the incidence rates for salivary gland tumors increased since the 1980s, with rates higher in whites than blacks. Established risk factors for salivary gland cancers are exposure to radiation, a history of cancer and exposure to nitrosamines [28–30]. Individuals treated during childhood (1939–1962) with radiation to reduce the size of their tonsils and adenoids are

at higher risk of developing these tumors and should be monitored [31]. Also, rising rates of salivary gland tumors have been reported mainly in the elderly, particularly those age 70 and over [29]. Explanations suggested were the recent increased use of fine needle aspiration and higher utilization of health services by the elderly population [29]. Further analyses looking at age-specific patterns are needed using SEER and the combined SEER/Medicare databases.

Other risk factors include exposure to viruses such as human papilloma virus (HPV) [32,33] and human immunodeficiency virus type 1 (HIV-1) [34]. HPV was detected in approximately 15% of squamous cell carcinomas of the head and neck [32,33]. Recently, it was shown that HPV has a predilection for certain anatomical sites, especially the tonsillar region [32]. The few OCP cancers occurring in individuals without a prior history of tobacco and alcohol use may be related to exposure to the virus [33–35]. Whether or not observed increases in cancer of the tonsils among white males and increases in tongue cancer among whites in the USA are related to HPV needs to be further explored.

In the absence of HIV-1 infection, KS is rare [34]. Although the SEER program does not collect information on HIV seropositivity, the increase in Kaposi's sarcoma began during the mid-1980s and continued into

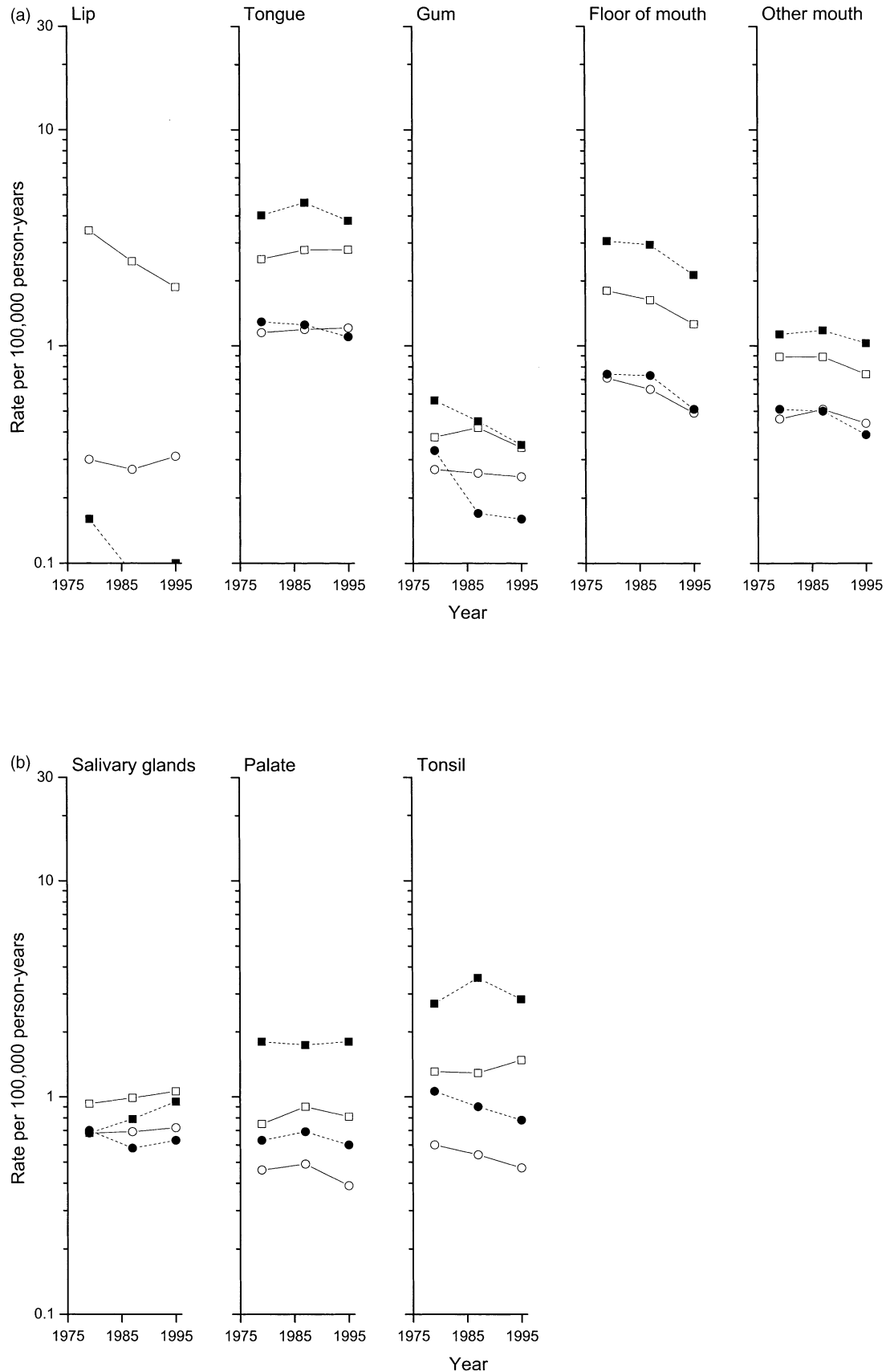


Fig. 2. (a–c) 1975–1982 to 1991–1998 age-adjusted (world) incidence trends by site. Oral cavity and pharynx cancers in the nine SEER areas.

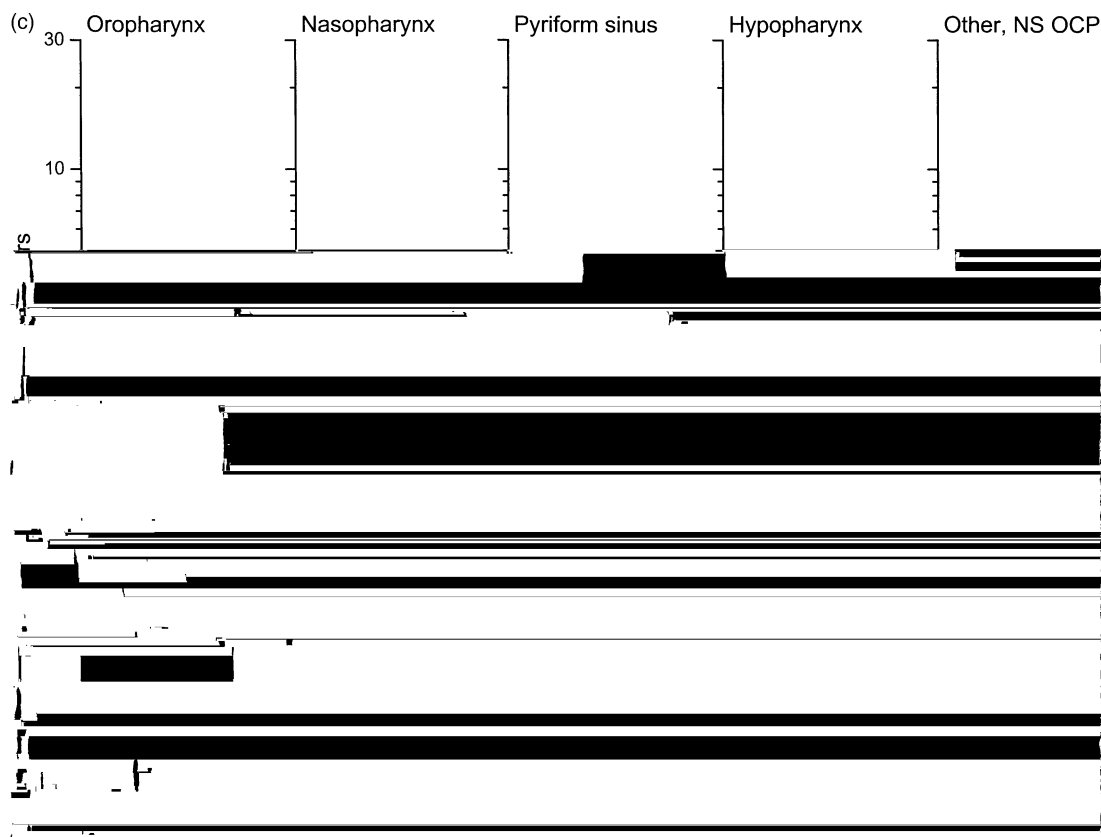


Fig. 2. (Continued).

1990s, a period of time coinciding with the HIV epidemic in the United States. Another virus related to OCP cancers is Epstein–Barr virus (EBV). EBV has been linked to nasopharynx cancers and a rare squamous cell carcinoma of the salivary glands among Inuit Canadians, Alaskans and Greenland Eskimos, but this association has not been found in other populations [29]. This analysis showed a slight increased in salivary glands among males (Fig. 2B). More information is needed in the role of viruses and the etiology of OCP cancers.

5. Conclusions

Because the patterns and etiologies differ, routine tabulations should report rates for the oral cavity separately from those for the pharynx. Furthermore, it would be useful for the present category of gum and other oral cavity to be broken down into gingiva, cheek and vestibule, other mouth, and palate. These suggestions would be helpful in the surveillance of trends, because although these cancers are related to behavioral and environmental exposures such as use of tobacco products, consumption of alcohol, and infection with certain viruses, the mechanisms may vary according to specific site and type.

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